5.0. QUALITY CONTROL

The goal of a quality assurance program is to produce data that are of known and acceptable quality. The quality of the data depends on procedures followed both in the field and in the laboratory. Therefore, part of the quality assurance program is the collection and analysis of quality control samples.

5.1. SAMPLING QUALITY CONTROL.

The sampling plan should include specific quality control requirements to meet the data quality objectives. These objectives are usually met through the use of quality control samples such as replicates, blanks, and sometimes performance evaluation samples. Unless the specific data needs at a site allow lesser or stricter quality assurance, the minimum guidelines given in the following sections apply:

5.1.1 Quality Control Samples for Sampling.

Replicates should be collected at a minimum frequency of 5%, with minimum of one set of duplicates per batch. Travel blanks should be submitted with each sample shipment. Field and equipment blanks, if needed, should be collected at the frequency of one per sampling day.

Field replicate samples:

Field replicate samples consist of either co-located samples (i.e., samples collected consecutively from nearly the same location) or split samples (i.e., samples which have been divided up from one homogenized sample). Co-located samples allow an estimate to be made of total variability, including sampling variability, whereas split samples are better for estimating transportation and laboratory variability. Replicates should be collected at a minimum rate of 5%, that is, one well in every 20 wells should be sampled twice for co-located samples or twice as much water collected, homogenized, and split into twice as many containers for split samples. Split samples are also used when two different parties are sampling the same site and verification of analytical results is necessary.

Sampling blanks:

Blank samples should be included in order to determine if field procedures such as collection, preservation, shipping, or decontamination are resulting in contamination of the samples, thereby yielding concentrations of some parameters of interest higher than actually exist in the field. These blank samples are of several kinds:

- Equipment blanks are collected when sampling equipment is decontaminated in the field as a check on the decontamination procedure. Equipment blanks may be relevant whenever the integrity of the sampling equipment is questioned. For water samples, clean water is collected using the equipment in question and sent to the lab with the other samples for analysis. In some cases, if holding times are not too short, the equipment blanks may be collected and stored and analyzed only if contaminants are found in the samples.

- Travel blanks (or trip blanks) should accompany sample containers to and from the field. They consist of sample containers which are filled in the laboratory with purified water, taken into the field, and added to each cooler before it is transported to the lab. These travel blanks are especially important for volatile samples in which other samples containing high concentration of parameters of interest may leak in the cooler and contaminate other samples. Travel blanks are generally not used for other media such as soil.

- Field blanks should be collected at specified frequencies, which will vary according to the probability of contamination or cross-contamination. They consist of purified water, such as HPLC Grade or pesticide grade water (in the case of water samples) which is taken into the field and transferred from the water container to the individual sample containers in the field as a check on contamination in the atmosphere at the site. The purpose of the field blank is to verify that none of the analytes of interest measured in the field samples resulted from contamination of the samples during sampling. If the purified water is also poured through sampling equipment before being added to the sample containers, the field blanks may also substitute for equipment blanks.

- Temperature blanks, appropriate contained filled with water should be submitted for each cooler.

Background samples:
Background samples are collected from the site in the exact manner as the regular samples. Background samples may be used as a quality control sample, especially for non-aqueous samples, to look for sampling or laboratory effects on concentration. The more common use for background samples is to establish a background concentration for those parameters which occur in the area of the site.

Control and/or spiked samples:

- Spiked or control samples: Performance evaluation (PE) samples include all spiked samples and standard solutions of known composition included with the samples sent to the laboratory from the field as a measure of the potential loss of analyte on

shipping and for recovery of analytes from a particular medium. Field spikes may also be desired when preservation techniques are in question. These include field samples which are spiked with a known amount of a parameter(s). They also include standard solutions of a known concentration obtained from a laboratory (e.g., ECL or EPA laboratory) or commercial source, labeled as a sample, and sent blind to the laboratory.

5.1.2 Minimum Recommended for Sampling QC Samples.

SAMPLE TYPE	RATE, BASED ON TOTAL SAMPLE LOAD
Replicate Samples:	
• Co-located or split	5% or 1 per sampling event for each type of media or location sampled.
Blanks:	
• Travel Blanks[1]	1 per sample for each procedure, for each sampling event.
• Temperature Blanks[1]	1 per sample for each cooler.
• Equipment Blanks[1]	1 per decontamination event in the field (as needed).
Spike or Control Samples[1]	5% for each procedure if the integrity of the sample warrants it.
Background Samples - may be used for matrix spiking	Varies, see Section 5.1

[1] May not be necessary possible with all sample types

5.1.3 QC Samples for a Sampling Activity.

Assume a sampling project consists of six water samples and three soil samples over a period of two days. The analyses required are volatile organics (EPA SW 846 Method 8260), metals, plus semi-volatile organics (EPA SW 846 Method 8270). The total number of samples collected would be:

Day 1:

Equipment Blank (if needed to confirm decontamination):
1 x 1L (8270), 1 x 1L (metals), 2 x 40mL (8260)

Well 1: 1 x 1L (8270), 1 x 1L (metals), 2 x 40mL (8260)

Well 2: 1 x 1L (8270), 1 x 1L (metals), 2 x 40mL (8240)

Well 3: 1 x 1L (8270), 1 x 1L (metals), 2 x 40mL (8260)

Well 4: 1 x 1L (8270), 1 x 1L (metals), 2 x 40mL (8260)

Well 4 Replicate (split): 1 x 1L (8270), 1 x 1L (metals), 2 x 40mL (8260)

Travel Blank: 2 x 40mL (8260), 1 x 1L (8270), 1 x 1L (metals)

Day 2:

Equipment Blank (if needed to confirm decontamination):
1 x 1L (8270), 1 x 1L (metals), 2 x 40mL (8260)

Well 5: 1 x 1L (8270), 1 x 1L (metals), 2 x 40mL (8260)

Well 6: 1 x 1L (8270), 1 x 1L (metals), 2 x 40mL (8260)

Travel Blank: 2 x 40mL (VOA)

Soil 1:1 x 200g.(8270, metals),1 Single transfer sampler e.g. Encore™ (8260)

Soil 2:1 x 200g.(8270, metals),1 Single transfer sampler e.g. Encore™ (8260)

Soil 3: 1x200g.(8270, metals),1 Single transfer sampler e.g. Encore™ (8260)

Soil 3 duplicate: 1 x 200g.(8270, metals),1 Single transfer sampler e.g. Encore™ (8260)

Control Sample: 1 x 100g. (if available, for 8270)

Control Sample: 1 x 200g. (if available, for metals)

5.2 LABORATORY QUALITY CONTROL

5.2.1 Routine Laboratory Quality Control Practices.

Laboratory blanks, and spike samples are usually analyzed at a minimum of once for every batch of samples or type of matrix or 20 samples, whichever is more frequent.

Duplicate samples are analyzed at a minimum of once for every batch of samples or type of matrix or 20 samples, which ever is more frequent.

The spike contains target analytes, typically spiked either at the level of each analyte present or at the concentration of the mid-range calibration standard, whichever is higher. If it is of significance to know the accuracy at the regulatory limit, spikes may be made at this regulatory limit.

The following general quality control practices are employed at ECL on a routine basis:

- At least a three point calibration for inorganic analysis (except ICP) and a 5 point calibration for organic analysis are performed on all sample analysis. If a calibration blank is analyzed, this will constitute an additional point.

- A calibration standard is analyzed to verify the calibration. This method standard consists of a reference standard from a different source than the calibration standards. The concentration of this standard is near the mid-point of the calibration curve.

- A method blank is analyzed to demonstrate the existence, if any, of contamination and its magnitude.

- Duplicates are analyzed to measure subsampling and analytical precision. At times, a matrix spike (MS) and a matrix spike duplicate (MSD) are used for this measure instead of the duplicates.

- A spiked sample is analyzed to measure accuracy (or bias) in sample preparation and analysis.

In addition, the following quality control samples may be included for special projects:

- Internal quality control samples of known composition. These samples may be submitted as blind samples to the laboratory.

Further, specialized analytical techniques such as GC/MS and ICP may have additional

quality control requirements specified by the analytical methods. These include tuning data for GC/MS, interference check standards for ICP, etc.

5.3 REFERENCES.

1) Taylor, J. K. and Stanley, T. W. Quality Assurance for Environmental Measurements. ASTM STP 876. ASTM (1985).